REMARKS

New claims 35 and 36 have been added. No new matter was added. Accordingly, claims 2, 3, 14, 20 and 34-36 are pending. Clams 15-19 and 21-25 are withdrawn as being directed to a non-elected species but remain in the application in the event that they can be re-joined. Applicants submit arguments for overcoming the rejections based on the prior art of record and respectfully submit that the present application is in condition for allowance.

Claim Rejections - 35 USC §103(a)

> *In the Office Action of October 11, 2007, claims 2, 3, 14, 20 and 34 are rejected under 35 USC §103(a) as being obvious over the publication of Fan et al. titled "Deformation behavior of Zr-based bulk nanocrystalline amorphous alloys" in view of U.S. Patent No. 6,096,640 of Hu.*

In response to the above referenced rejection, Applicants respectfully submit that:

(i) it is an error to interpret the material of Fan et al. as being "only slightly different" to the sputtering target required by claim 2 of the present application, particularly taking into account the dimensional requirements of sputtering targets; and

(ii) an adequate rationale for why one of ordinary skill in the art would modify Fan et al. in view of Hu sufficient to support the legal conclusion of obviousness has not been provided.

Accordingly, for these reasons which are discussed in greater detail below, Applicants respectfully request reconsideration and removal of the rejection of the claims as being obvious over Fan et al. in view of Hu.

(i) Not "only slightly different"

The Office Action of October 11, 2007 includes the following statement with respect to the Fan et al. publication and the present invention:

> "Fan et al. disclose an amorphous metallic glass (abstract), which reasonably appear to be ***only slightly different*** than the claimed amorphous metallic glass in the instant claim 2."

Applicants respectfully disagree with this interpretation and believe this to be an error.

It is important to consider that claim 2 of the present application is directed to a sputtering target. This term is used both within the preamble of the claim and after the preamble and provides a claim limitation. It is inherent by the use of the term "sputtering target" that its structure be of a size sufficient for use as a sputtering target from which thin films can be formed by sputtering techniques. With respect to dimensions of sputtering targets, see, for example, page 9, line 9, of the present application, as filed, which discloses as "Example 1" a disc-shaped sputtering target having a diameter of 216mm and thickness of 8.4mm. Also, see page 8, lines 16-17, of the present application, as filed, which states that "the target of the present application is characterized in that a target of 100mmϕ can be manufactured easily." This statement provides support for the subject matter of new claims 35 and 36 of the present application. No new matter was added.

Fan et al. disclose a method of making an ingot by "arc melting the mixtures of pure metals in a purified argon atmosphere and cast into a copper mould in vacuum." (See the sentence bridging columns 1 and 2 on page R3761 of the Fan et al. publication.) This method clearly relies on the use of a copper mold to perform arc melting and quenching. Such a method is disclosed as "conventional" on page 1, line 30, to page 2, line 3, of the present application, as filed. The present application also discusses the disadvantages of such a method, namely, that it

"incurs high costs" and that "the manufacturable shape is also limited, and there is a problem in that only a target of several cmϕ can be manufactured." (See page 2, lines 10-15, of the present application, as filed.)

Fan et al. produces and discusses an ingot or specimen that is of a very small size relative to the size of a typical sputtering target. The specimen of Fan et al. is 2mm in diameter and 4.5 mm long. (See column 2, lines 16-17, of page R3761 of the Fan et al. publication.) These dimensions are clearly insufficient to provide a structure or body of a sputtering target.

Applicants respectfully submit that the method of Fan et al. cannot be used to make a specimen of sufficient dimensions to properly function as a sputtering target. This is to say that if an ingot were made according to Fan et al. in the size required of a sputtering target (ie., more than several cm in diameter) it would clearly not have a structure that is "only slightly different" than that required by claim 2 of the present application.

When manufacturing bulk metal glass by quenching molten metal, the cooling speed of the surface of the material forming the ingot that contacts the mold will differ greatly from the cooling speed of material that is embedded deep within the interior of the ingot spaced from the mold. Accordingly, crystallite size of surface areas of the formed bulk metal glass ingot will differ greatly from that of areas centered deep within the bulk metal glass ingot. If the crystallite size of a sputtering target is uneven with respect to outer and inner areas of a bulk metal glass sputtering target, defects such as particles will arise on the sputtered thin film and film composition will be uneven. Such a sputtering target would not meet the limitations required by claim 2 of the present application.

In contrast, when sintering gas atomized powder as required by the present invention, there is no temperature difference at outer and inner areas of the sputtering target and crystallite

size is uniform throughout the target. Thus, the above referenced defects of particle generation and uneven thin film composition are avoided with the sputtering target of the present invention.

Further, cooling speed of the sintered gas atomized powder target of the present invention is fast at 10^3K/sec. In comparison, cooling speed of the cast ingot of Fan et al. is relatively slow at 10^{-3} to 10^1K/sec. Consequently, with respect to the present invention, it is possible to manufacture a relatively large bulk sintered compact suitable for use as a sputtering target in which the crystal structure of the target is ultrafine and uniform. The same cannot be said for the arc melting and quenching method of Fan et al. which can only form ultrafine and uniform structures of very limited size. If the size of the specimen of Fan et al. is increased to sputtering target size, it would not have an ultrafine or uniform crystal structure as required by claim 2 of the present application.

Accordingly, Applicants respectfully submit that the product produced according to Fan et al., particularly when made to a size suitable for use as a sputtering target, is clearly not "only slightly different" from the product produced according to the present invention. The present invention yields a different crystal structure and provides dramatically superior sputtering characteristics.

For at least this reason, Applicants respectfully submit that claim 2 and the present application is not obvious in view of the Fan et al. publication. The present invention provides an advance in the art of metallic glass sputtering targets that is not disclosed, suggested, taught or contemplated by the Fan et al. publication. One of ordinary skill in the art is not taught by Fan et al. how to provide a sputtering target required by claim 2. For this reason, Applicants submit that the invention of claim 2 of the present application is meritorious and worthy of a patent.

(ii) No Adequate Rationale for Modifying Fan et al. in view of Hu

The U.S. Board of Patent Appeals has consistently held that rejections on obviousness grounds cannot be sustained by mere conclusory statements. Instead, there must be articulate reasoning with rational underpinning to support the legal conclusion of obviousness.

Applicants respectfully submit that a proper prima facie case of obviousness cannot be made under 35 USC §103(a) with Fan et al. in view of Hu because an adequate rationale has not been articulated for combining the teachings of Fan et al. with Hu to attain the claimed invention. Further, one of ordinary skill in the art using common sense at the time of the invention would not have reasonably looked to the teachings of Fan et al. (which is limited to forming small size specimens) in connection with producing a sputtering target as disclosed by Hu.

In the Office Action dated October 11, 2007, the reasoning for combining Fan et al. in view of Hu. is stated, as follows:

> "It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the bulk metallic glass produced in the process of Fan et al. into a sputtering target as disclosed by Hu ('640) ***in order to deposit a layer of material of desired composition and structure*** as disclosed by Hu ('640) (col. 5, lines 60-col. 6, line 2)."

Applicants respectfully submit that the above referenced reasoning (ie., "in order to deposit a layer of material of desired composition and structure") is a mere conclusory statement insufficient to support the legal conclusion of obviousness.

In addition, Applicants submit that there is no rationale for combining Fan et al. and Hu. As discussed above, the material of Fan et al. can only be produced in relatively small sizes (ie., 2mm in diameter). Further, when manufacturing bulk metal glass by quenching molten metal, the cooling speed of the surface of the material forming the ingot that contacts the mold will differ greatly from the cooling speed of material that is embedded deep within the interior of the

ingot spaced from the mold. Accordingly, crystallite size of surface areas of the formed bulk metal glass ingot will differ greatly from that of areas centered deep within the bulk metal glass ingot. Also, the cooling speed of the material of the cast ingot of Fan et al. is relatively slow at 10^{-3} to 10^{1}K/sec. If the crystallite size of the thus produced sputtering target is uneven with respect to outer and inner areas of a bulk metal glass sputtering target, defects such as particles will arise on the sputtered thin film and film composition will be uneven.

Still further, one of ordinary skill in the art would be aware of the information disclosed on page 2, lines 10-15, of the present application, as filed, which states the disadvantages of the material of Fan et al., namely, that it "incurs high costs" to produce and that "the manufacturable shape is also limited, and there is a problem in that only a target of several cmϕ can be manufactured."

Accordingly, one of ordinary skill in the art would avoid using the material of Fan et al. as a sputtering target for these reasons. New claims 35 and 36 of the present application expressly require the sputtering target to be at least 100mm in diameter. The 2mm diameter specimen of Fan et al. is clearly not useful as a sputtering target, and such a specimen cannot be made to the required size while maintaining a crystal structure that is ultrafine and uniform as required by the claims of the present application. Accordingly, it would neither be obvious nor possible to produce the sputtering target required by Hu based on the teachings provided by the Fan et al. publication.

For these reasons, Applicants respectfully request reconsideration and removal of the obviousness rejections of the claims of the present application. The present invention yields a different crystal structure and provides dramatically superior sputtering characteristics.

Conclusion

In view of the above remarks, Applicants respectfully submit that the rejections have been overcome and that the present application is in condition for allowance. Thus, a favorable action on the merits is therefore requested.

Please charge any deficiency or credit any overpayment for entering this Amendment to our deposit account no. 08-3040.

Respectfully submitted,
Howson & Howson LLP
Attorneys for Applicants

By /William Bak/
William Bak
Reg. No. 37,277
501 Office Center Drive
Suite 210
Fort Washington, PA 19034
(215) 540-9216